

Original Research Article

Effect of vine management on morpho-physiological characters and yield of pumpkin

ABSTRACT

The present study was carried out at the Instructional cum Research Farm, Department of Horticulture, Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali with an aim to study the morpho-physiological characters and yield as influenced by vine management. The treatments were: T₁ (Trimming of growing tip of the primary vine at 8th node stage), T₂ (Trimming of growing tip of the primary vine at 10th node stage), T₃ (Trimming of growing tip of the primary vine at 12th node stage), T₄ (Trimming of growing tip of the secondary vine at 6th node stage), T₅ (Trimming of growing tip of the secondary vine at 8th node stage), T₆ (Removal of all tertiary vines), T₇ (Retention of two tertiary vines) and T₈ (control without pruning). The study revealed that among the treatments, T₄ recorded the highest primary vine length and inter-nodal length of primary vine at 60, 90 DAS and at 1st harvest. Number of primary vine was found to be highest under T₅ while T₃ recorded maximum number of secondary vines, inter-nodal length of secondary vines, the highest total leaf chlorophyll content, relative leaf water content, leaf area index and maximum fruit yield. Therefore, trimming of growing tip of the primary vine at 12th node stage can be used as a vine management technique in pumpkin to get maximum yield.

Comment [C1]: Of ?

Keywords: *trimming, node stage, vine, pumpkin, morphological, physiological, yield.*

1. INTRODUCTION

The ancestors of pumpkin (*Cucurbita moschata*) are from Mexico and Peru. The crop can thrive in both hemispheres' tropics and is tolerant to warm weather. According to botany, the pumpkin's fruit is a variety of berry called a pepo and is regarded as extremely valuable vegetable. With chromosomal number $2x=40$, pumpkin is an allopolyploid [1]. A relatively fertile, well-drained soil is necessary for growing pumpkin. Medium-textured soils with good internal drainage and a high water-holding capacity produce the highest yields. They can be grown on a variety of soils, though it is not advised to use heavy clay soils. Although they are delicate to salinity and acidity, they can thrive in soils that range from mildly acidic (pH 6.8) to moderately alkaline (pH 8.0).

Pumpkins are hardy, so even if a large number of leaves or a significant piece of the vine are lost, injured or removed, the plant will quickly sprout new secondary vines to replace those that were lost [2]. Although the productivity and quality of fruits depends on different factors but proper vine management of the crop have positive influence of different morpho-physiological qualities which in turn increase the yield and quality of the fruits.

A plant's function is impacted by pruning since it has an impact on the plant's ability to bear or produce fruit. It establishes and improves the plant's ability to produce fruits. By pruning, the plant or vine is forced to produce fruits of higher quality by having the sap flow driven or directed towards the part of the plant that bears fruit. Due to the farmers' poor information and limited knowledge, the pruning technique and its applications in pumpkin are ever

Keeping in view that no systematic research work on effect of vine management on growth and yield of pumpkin have been carried out in Assam condition the present investigation was conducted.

Comment [C2]: The phrase is meaningless.

2. MATERIALS AND METHODS

The investigation was conducted at the Instructional cum Research Farm, Department of Horticulture, Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali (26.7° N latitude and 90.5° E longitude and at 105 m above MSL) from October, 2021 to April, 2022. The experiment was laid out on Randomized block design consisting of 8 treatments with 3 replications such as T₁ (Trimming of growing tip of the primary vine at 8th node stage), T₂ (Trimming of growing tip of the primary vine at 10th node stage), T₃ (Trimming of growing tip of the primary vine at 12th node stage), T₄ (Trimming of growing tip of the secondary vine at 6th node stage), T₅ (Trimming of growing tip of the secondary vine at 8th node stage), T₆ (Removal of all tertiary vines), T₇ (Retention of two tertiary vines) and T₈ (control without pruning) by using the same variety of pumpkin. Pruning was done when the plants reached their pruning stage according to different treatment using secateurs and was cut above the node to avoid any injury to the node. In order to ensure a healthy crop standard cultural practices were performed starting with the preparation of experimental plot by thorough ploughing followed by harrowing and levelling. Then the whole plot was divided into 24 numbers of plots with 3 replications having 8 plots each. Each plot/bed was prepared maintaining a size of 9 m x 4.5 m. Then pits were dug of size 30 cm³ and were filled with mixture of cow dung and top soil. Seeds were sown in the pits with spacing of 3 m x 1.5 m. At first 2-3 seeds were sown in each pit and later on thinning was done and the healthiest plant was kept in each pit.

Morphological parameters such as length of the primary vine (cm), inter-nodal length of the primary and secondary vine (cm), number of primary and secondary vines at 60, 90 days after sowing (DAS) and at 1st harvest were recorded. For the physiological parameters total leaf chlorophyll content (mg g⁻¹ fw), relative leaf water content (%) and leaf area index at 60 and 90 DAS were recorded. Yield parameters such as fruit yield per plant and fruit yield per hectare were recorded. Observation made during field experimentation and data obtained from laboratory determinations were subjected to analysis of variance. Significance or non-significance of the variance due to treatments was determined by calculating the respective 'F' values by following the method described by [3]. The significance of difference between mean values of the parameters of the treatment was tested by computing critical difference (CD at 5%) estimates.

3 RESULTS AND DISCUSSION

3.1 Effect of vine management on morphological parameters

3.1.1 Length of primary vine

The findings presented in Table 1 show that pruning had significant effect on length of primary vine. The highest primary vine length (262.67, 361.56 and 438.89 cm) at 60, 90 DAS and at 1st harvest respectively was found under the treatment T₄ while the lowest was recorded under the treatment T₁ (112.42, 115.42 and 114.50 cm) at all the three stages i.e. 60, 90 DAS and at 1st harvest. The highest primary vine length in T₄ (trimming of growing tip of the secondary vine at 6th node stage) which could be explained by the plants absorbing enough nutrients and light to enable healthy growth

and development, thus increasing the length. In eggplant [4] reported similar findings. According to [5] the maximum vine length may also be ascribed to an increase in cell division and cell enlargement which might be another factor that promotes a larger inter-nodal length and, in turn, a longer vine length. The shortest primary vine length in T₁ (trimming of growing tip of the primary vine at 8th node stage) might be plausible as a result of the vines' decreased auxin concentration [6]. Auxin, a hormone which promotes growth, is in charge of apical dominance, which encourages apical growth in plants. However, when pruning operations are carried out, apical dominance breaks down which reduces apical growth and encourages the growth of lateral branches. Removing the apical bud also encouraged growth and development in okra [7]. In long melon, the maximum length of primary vine was recorded when pruning was done by removal of all lateral branches as flow of nutrients will be available only to the main vine as reported by [8]. When the main stem is pruned, concentration of auxin falls while concentration of cytokinin rises. The expansion of lateral shoots is induced by cytokinin.

Comment [C3]: The phrase is wrong

Comment [C4]: What do you mean?

3.1.2 Inter-nodal length of primary and secondary vine

The inter-nodal length was also affected due to pruning (Table 1). The highest inter-nodal length of the primary vine was recorded by T₄ (14.62 cm) at 60 DAS while T₁ recorded the lowest (13.13 cm) inter-nodal length of primary vine. Similarly, T₄ recorded the highest inter-nodal length of the primary vine (16.20 cm and 17.71 cm, respectively) at 90 DAS and at 1st harvest and T₁ recorded under the lowest (14.42 and 14.69 cm at 90 DAS and 1st harvest), respectively. By limiting the growth of unproductive plant parts, pruning operations promote regulated growth by enhancing photosynthetic efficiency, which in turn promotes cell expansion in other plant parts. This is in close proximity with the findings of [9], [10], [11], [12], [6].

While measuring inter-nodal length of secondary vine, the highest (13.74 cm) was recorded by the treatment T₃ at 60 DAS which was statistically at par with T₅ (13.62 cm) and T₂ (13.35 cm). Similarly, at 90 DAS and at 1st harvest the treatment T₃ recorded the highest (15.18 cm and 16.4 cm respectively) while retention of two tertiary vines (T₇) resulted in the lowest inter-nodal length of secondary vine (10.68, 10.93 and 11.26 cm) at 60, 90 DAS and at 1st harvest, respectively. The highest inter-nodal length of the secondary vine under T₃ might be attributed to larger cytokinin concentration that encouraged more cell division, which resulted in longer length of secondary vine. This supports the findings of [11] which explained that by inhibiting auxin concentration, cytokinin concentration increased and extension of secondary vines was subsequently improved.

Table 1. Effect of vine management on length of primary vine, inter-nodal length of primary and secondary vine at 60, 90 DAS and at 1st harvest.

Treatment	Length of the primary vine (cm)	Inter-nodal length of primary vine (cm)	Inter-nodal length of secondary vine (cm)
-----------	---------------------------------	---	---

	60 DAS	90 DAS	At1 st arvest	60 DAS	90 DAS	At1 st arvest	60 DAS	90 DAS	At1 st arvest
T ₁	112.42	115.42	114.50	13.13	14.42	14.69	11.30	13.85	14.44
T ₂	131.38	134.64	132.71	13.59	15.90	15.96	13.35	14.37	15.59
T ₃	161.24	163.47	162.33	14.17	15.14	16.10	13.74	15.18	16.40
T ₄	262.67	361.56	438.89	14.62	16.20	17.71	12.54	13.54	13.51
T ₅	245.99	355.00	418.14	13.33	14.81	15.35	13.62	13.48	14.62
T ₆	237.75	348.75	427.51	14.52	15.54	16.47	12.02	12.62	14.41
T ₇	250.70	344.73	421.73	14.28	15.65	15.95	10.68	10.93	11.26
T ₈	221.27	336.53	406.53	13.15	14.69	15.63	11.28	12.76	12.83
S.Ed±	0.45	0.55	0.56	0.06	0.20	0.23	0.36	0.32	0.26
C.D.(P=0.05)	1.12	1.18	1.21	0.13	0.42	0.50	0.77	0.69	0.56

T₁: Trimming of growing tip of the primary vine at 8th node stage, T₂: trimming of growing tip of the primary vine at 10th node stage, T₃: trimming of growing tip of the primary vine at 12th node stage, T₄: trimming of growing tip of the secondary vine at 6th node stage, T₅: trimming of growing tip of the secondary vine at 8th node stage, T₆: removal of all tertiary vines, T₇: retention of two tertiary vines and T₈: control without pruning.

3.1.3 Number of primary and secondary vine

Table 2 revealed that the number of primary vines and secondary vines exhibited significant variation among the different pruning treatments. At 60, 90 DAS and at 1st harvest the highest (5.47, 5.77 and 6.30) number of primary vines was recorded by T₅. On the other hand, lowest (3.30, 4.61 and 5.39) number of primary vines was recorded by T₈ at 60, 90 DAS and at 1st harvest, respectively. T₃ at 60, 90 DAS and at 1st harvest recorded the highest (7.63, 8.59 and 8.90) respectively, while the lowest (3.70, 4.06 and 5.22) secondary vine number was recorded by T₈ at 60, 90 DAS and at 1st harvest. As for the number of primary vines, maximum was recorded by the treatment T₅ while T₈ recorded the minimum at all the three stages. Since pruning prevents the growth of apical buds and promotes the development of secondary vines, it also has an effect on the number of lateral branches. Pruning of the primary vine was performed in treatment T₃, which might have resulted in increasing number of secondary vines as apical dominance was inhibited because pruning suppresses apical dominance [13].

Table 2. Effect of vine management on number of primary and secondary vines at 60, 90 DAS and at 1st harvest.

Treatment	Number of primary vines			Number of secondary vines		
	60DAS	90DAS	At 1 st harvest	60DAS	90DAS	At 1 st harvest
T ₁	3.42	4.66	5.86	6.74	7.73	8.63
T ₂	5.23	5.60	5.91	5.48	7.16	7.46
T ₃	4.54	5.69	6.07	7.63	8.59	8.90
T ₄	3.86	4.68	4.95	4.34	5.41	6.35
T ₅	5.47	5.77	6.30	4.47	4.94	5.81
T ₆	3.68	5.10	5.30	4.52	5.09	5.50
T ₇	5.15	5.38	5.78	5.22	6.06	6.95
T ₈	3.30	4.61	5.39	3.70	4.06	5.22
SEd±	0.30	0.22	0.26	0.33	0.44	0.27
C.D. (P=0.05)	0.64	0.47	0.56	0.71	0.94	0.59

T₁: Trimming of growing tip of the primary vine at 8th node stage, T₂: trimming of growing tip of the primary vine at 10th node stage, T₃: trimming of growing tip of the primary vine at 12th node stage, T₄: trimming of growing tip of the secondary vine at 6th node stage, T₅: trimming of growing tip of the secondary vine at 8th node stage, T₆: removal of all tertiary vines, T₇: retention of two tertiary vines and T₈: control without pruning

3.2 Effect of vine management on physiological parameters

3.2.1 Total leaf chlorophyll content

A perusal of data presented in Table 3 indicated that the total leaf chlorophyll content was significantly affected by different pruning treatments. After 60 days of sowing T₃ recorded the highest (1.83 mg g⁻¹fw) total leaf chlorophyll content which was significantly at par with T₆ (1.79 mg g⁻¹fw). The superiority was maintained by T₃ at 90 DAS also with the highest (2.08 mg g⁻¹fw) total leaf chlorophyll content followed by T₆ (1.95 mg g⁻¹fw) and T₂ (1.94 mg g⁻¹fw) while T₈ recorded the lowest (1.44 and 1.71 mg g⁻¹fw) at 60 and 90 DAS. Similar findings were reported by [14] in tomato and [15] in pointed gourd where maximum chlorophyll content was found under pruned plants as compared to the unpruned plants. The green leaves are the major factor contributing in photosynthesis, according to [16]. The vegetative growth is limited under pruning operations which makes light to penetrate easily in the inner canopy leading to more dry matter production which in turn increases the photosynthetic efficiency [17].

3.2.2 Relative leaf water content

Significant difference was noticed for relative leaf water content (Table 3). The highest relative leaf water content was recorded by T₃ (78.11%) followed by T₂ (75.62%) and T₁ (73.28%) while the lowest (69.69%) was by T₈ at 60 DAS. Similarly, T₃ recorded the highest (86.15%) relative leaf water content at 90 DAS whereas, T₈ recorded the lowest (73.78 %) relative leaf water content with T₆ (74.23%) at par. The relative leaf water content is one of the main determinants of the water condition of the plant

body. It maintains equilibrium between a plant's water intake and transpiration rate [18]. [17] opined that pruning can reduce vegetative growth and increase light penetration into the inner canopy, but it also raises the temperature, which results in water loss. However, it was discovered from the current investigation that because of pruning on the main stem, T₃ resulted in more number of secondary vines and more number of leaves, which might have resulted in a dense canopy and less light penetration, resulting in higher relative leaf water content. The economic yield was substantially impacted by relative leaf water content as reported by [19].

3.2.3 Leaf area index

Leaf area index which was measured at 60 and 90 DAS also revealed to be significantly affected by different pruning treatments (Table 3). Maximum leaf area index was recorded in T₃ (1.87 and 1.96) while the minimum (1.35 and 1.46) was recorded in T₈ at both 60 and 90 DAS. Higher number of leaves results in higher leaf area index as leaves are the key component contributing to photosynthesis as they contain stomata. These findings are consistent with the present investigation. The highest leaf area index was recorded by treatment T₃ at both 60 and 90 days after sowing. In bottle gourd more number of leaves, total leaf area and leaf area index was recorded highest when pruning was done on secondary branch at 6th node stage [20]. [21] and [6] also reported similar results in cucumber as they found that the plants which were pruned on main stem recorded highest number of leaves. Highest number of secondary vines under T₃ might be the reason for increase in number of leaves per vine in the current investigation. As reported by [22] when leaf-fruit ratio is increased, it simultaneously results in higher number of fruits and more carbohydrate content. Pruning helps in controlling the plant growth, number of vines, leaves etc. which is helpful for the plant in yielding better and also checks the plant's health but when plants are kept in their natural state they show uncontrolled growth and also there is decrease in yield [11].

Table 3. Effect of vine management on total leaf chlorophyll content, relative leaf water content and leaf area index at 60 and 90 DAS.

Treatment	Total leaf chlorophyll content (mg g ⁻¹ fw)		Relative leaf water content (%)		Leaf area index	
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
T ₁	1.55	1.84	73.28	83.99	1.64	1.82
T ₂	1.76	1.94	75.62	85.56	1.75	1.85
T ₃	1.83	2.08	78.11	86.15	1.87	1.96
T ₄	1.54	1.85	71.39	79.37	1.54	1.59
T ₅	1.63	1.91	72.25	80.99	1.63	1.74
T ₆	1.79	1.95	70.29	74.23	1.61	1.66
T ₇	1.59	1.86	72.49	77.29	1.43	1.58
T ₈	1.44	1.71	69.69	73.78	1.35	1.46
SEd ±	0.02	0.02	0.40	0.42	0.05	0.11
C.D. (P=0.05)	0.06	0.05	0.87	0.91	0.12	0.25

T₁: Trimming of growing tip of the primary vine at 8th node stage, T₂: trimming of growing tip of the primary vine at 10th node stage, T₃: trimming of growing tip of the primary vine at 12th node stage, T₄: trimming of growing tip of the secondary vine at 6th node stage, T₅: trimming of growing

tip of the secondary vine at 8th node stage, T₆: removal of all tertiary vines, T₇: retention of two tertiary vines and T₈: control without pruning

3.3 Effect of vine management on yield per plant and per hectare

As depicted in Table 4, pruning had significant influence over fruit yield per plant (kg) and fruit yield per hectare (t/ha). Among the treatments, T₃ recorded the highest fruit yield per plant (15.47 kg) and fruit yield per hectare (27.88 t/ha) while T₈ recorded the lowest fruit yield per plant (8.57 kg) and fruit yield per hectare (15.48 t/ha). The highest production seen under the pruned plants may have been caused by larger or more number of fruits. This is consistent with the research done on cucumber by [23]. By allowing plants adequate light exposure, pruning boosted photosynthesis, which in turn increased source to sink ratio and raised the yield. Tomato and bitter gourd plants that had been pruned produced more fruit than the unpruned ones [24], [25] respectively. According to [26] pruning led to a reduction in the amount of wasted fruit, which raised the marketable yield of eggplant. When plants were pruned to four stems in greenhouse grown sweet pepper, fruit yield increased as compared to unpruned plants [27]. Similar results were found in capsicum by [28] and in chilli by [29].

Table 4. Effect of vine management on fruit yield per plant (kg) and fruit yield per hectare (t/ha)

Treatments	Fruit yield (kg/plant)	Fruit yield (t/ha)
T ₁	13.40	24.19
T ₂	11.85	21.36
T ₃	15.47	27.88
T ₄	12.61	22.78
T ₅	11.16	20.18
T ₆	11.10	20.05
T ₇	10.28	18.55
T ₈	8.57	15.48
SEd ±	0.03	0.02
C.D (P=0.05)	0.06	0.05

T₁: Trimming of growing tip of the primary vine at 8th node stage, T₂: trimming of growing tip of the primary vine at 10th node stage, T₃: trimming of growing tip of the primary vine at 12th node stage, T₄: trimming of growing tip of the secondary vine at 6th node stage, T₅: trimming of growing tip of the secondary vine at 8th node stage, T₆: removal of all tertiary vines, T₇: retention of two tertiary vines and T₈: control without pruning

4 CONCLUSION:

The study revealed that different pruning treatments significantly affected the morpho-physiological characters and yield of Pumpkin. Trimming of growing tip of the primary vine at 12th node stage (T₃) produced maximum yield with better physiological condition of the plant.

REFERENCES:

1. Gopalakrishnan TR. Vegetable Crops. Horticulture Science Series. New India Publishing Agency, New Delhi. 2007; 4: 129-132.
2. Astill Gregory. Pumpkins: Background & Statistics. United States Department of Agriculture Economic Research Service; 2018.
3. Panse VG, Sukhatme PV. Statistical Method for Agricultural workers. Indian Council of Agricultural Research, New Delhi; 1985.
4. Paksoy M, Akilli M. The effects of different prunings on the yield and quality of eggplant cultivars grown in the greenhouse conditions. *Acta Hort.* 1994; 366: 287-292.
5. Krishnamoorthy HN, Sandooja JK. Effect of ethereal and gibberellic acid on growth flowering and sex expression of (*Cucurbitapepo*) Haryana J. Hort. Sci. 2002; 10: 249-252.
6. Mardhiana M, Pradana AP, Adiwena M, Kartina K, Santoso D, Wijaya R, Maliki A. Effects of pruning on growth and yield of cucumber (*Cucumissativus*) Mercy variety in the acid soil of North Kalimantan, Indonesia. *Cell Biology and Development.* 2017; 1: 13-17.
7. Olasantan FO. Effect of leaf removal on the growth and yield of okra (*Abelmoschus esculentus*) and its relevance to leaf harvesting patterns and pest damage. *Experimental Agriculture.* 1998; 24: 449-455.
8. Singh AK, Sabir N, Jat GS, Singh J, Singh V, Singh A, Kumar A, Kumar J. Effect of spacing and pruning on growth, yield and economics of long melon (*Cucumismelo* var. *utilissimus*) under naturally ventilated polyhouse. *The Ind. J. of Agri. Sci.* 2021; 91: 885-89.
9. Yu K, Fan Q, Wang Y, Wei J, Ma Q, Yu D, Li J. Function of leafy sepals in Paris polyphylla: photosynthate allocation and partitioning to the fruit and rhizome. *Functional Plant Biology.* 2013; 40: 393-399.
10. Jat GS. Studies on hybrid seed production in bitter melon under insect-proof net house and open-field conditions. M Sc thesis, PG School, ICAR-IARI, New Delhi; 2011.
11. Coggins Jr CW, Lovatt CJ. Plant Growth Regulators. In: Ferguson L, Grafton Cardwell EE (eds) *Citrus Production Manual*. UC ANR, California; 2014.
12. Singh AK, Munsri AD, Veerpal S, Mukul K, Sellam P. Influence of gynoecious cucumber varieties and spacing on yield and economics during off-season production under protected condition in North Indian plains. *Intern. J. BasicApp. Agri. Res.* 2016; 14: 54-58
13. Ghosh A, Chikara J, Chaudhary D. Diminution of economic yield as affected by pruning and chemical manipulation of *Jatropha curcas* L. *Biomass and Bioenergy,* 2011; 35: 1021-1029.
14. Ahmad H, Yeasmin S, Rahul S, Mahbuba S, Uddin AJ. Influence of sucker pruning and old leaves removal on growth and yield of cherry tomato. *J. Biosci. Agri. Res.* 2017; 12: 1048-1053.
15. Gupta KK, Buragohain N, Gautam BP, Langthasa S, Goswami RK, Kalita MK. Impact of sprout management on growth, quality and yield of pointed gourd

- (*Trichosanthes dioica* Roxb.). Int. J. Curr. Microbiol. Appl. Sci. 2020; 9: 1030-1037.
16. Xu, Z, Zhou G. Responses of leaf stomatal density to water status and its relationship with photosynthesis in a grass. J Exp Bot. 2008; 59: 3317-3325.
 17. Preece JE, Read PE. The Biology of Horticulture. 2nd Ed. Copyright by John Wiley and Sons. New York, United States, 2005: pp.528.
 18. Lugojan C, Ciulca S. Evaluation of relative water content in winter wheat. J. Hort. Fores. Biotech. 2011; 15: 173-177.
 19. Ibrahim AH, Aldesuquy HS. Glycine Betaine and Shikimic Acid-induced modification in growth Criteria, water relation and productivity of droughted sorghum bicolor plants. Phytom (Horn, Austria). 2003; 43: 351-363.
 20. AnandM, Rohini N, Sadasakthi A. Influence of training and pinching on growth, flowering and physiological characters in bottle gourd cv. CBgH1. Trends Biosci. 2014; 7: 2524-2527.
 21. Ekwu LG, Nwokwu GN, Utobo EB. Effect of mulching materials and pruning on growth and yield of cucumber (*Cucumis sativus* L.). Nig. Agri. J. 2017; 48: 51-59.
 22. Fischer G, Almanza-Merchán PJ, Ramírez F. "Source-sink relationships in fruit species: A review." Revista Colombiana de Ciencias Hortícolas. 2012; 6: 238-253.
 23. Shivaraj D, Lakshminarayana D, Prasanth P, Ramesh T, Studies on the Effect of Pruning on Cucumber cv. Malini Grown Under Protected Conditions. Int. J. Curr. Microbio. App. Sci. 2018; 7: 2019-2023.
 24. Hesami A, Khorami SS, Hosseini SS. Effect of shoot pruning and flower thinning on quality and quantity of semi-determinate tomato (*Lycopersicon esculentum* Mill.). Notulae Scientia Biologicae. 2012; 4: 108-111.
 25. Palada MC, Chang LC. Suggested cultural practices for bitter melon. AVRDC. No. 3; 2003: pp 547.
 26. Paksoy M, Akella M. The effects of different prunings on the yield and quality of eggplant cultivars grown in the greenhouse conditions 2nd Symp. of Prot. Cultiv. of Solanaceae in Mild Winter Climates, Turkey; 1993.
 27. Jovicich E, Cantliffe DJ, Hochmuth GJ. Plant Density and Shoot Pruning Management on Yield of a Summer Greenhouse Sweet Pepper Crop. Hort. Sci. 1999; 34: 532E-532.
 28. Shetty GR, Manohar RK. Influence of pruning and growth regulators on flowering, fruit set and yield of coloured capsicum (*Capsicum annuum* L.) cv. Orobelle under naturally ventilated greenhouse. Asian J. Hort. 2008; 3(2): 213-216.
 29. Laxman S, Mukherjee S. Effect of foliar application of urea and NAA on yield and yield attributes of chilli (*Capsicum annuum* var: longum). Agri. Sci Digest. 2000; 20: 116-111.

UNDER PEER REVIEW